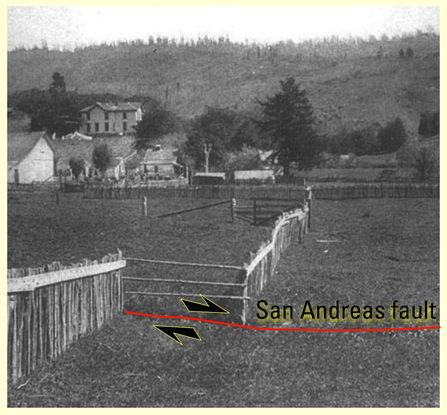
The Earth is Moving!

The earth moved along a fault during the 1906 earthquake

Scientists making measurements after the 1906 earthquake saw clear evidence that the earth moved during the earthquake.

This fence was torn apart when the two sides of the fault moved relative to one another.



Surveyors measure earth movement.

Continued measurements showed the Earth continued to move – even in the years *after* the quake.

Unlike during the earthquake, however, this later motion was not along the fault – the entire region was deforming. What were these scientists seeing?

Plate motions cause earthquakes.

After 1906, scientists recognized that the motion that continued after the earthquake would cause stress to build up. Releasing that stress and strain is what causes earthquakes.

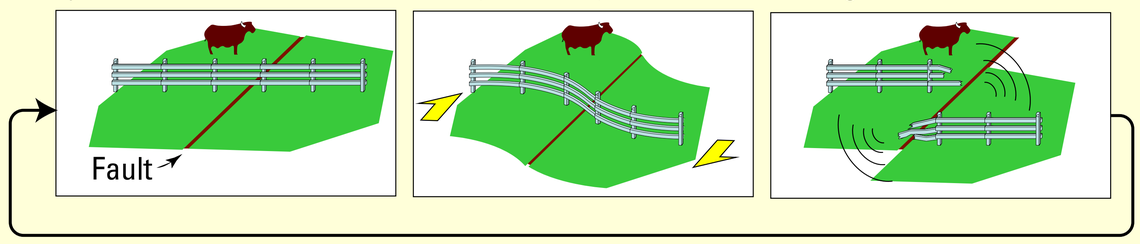
Before and After an Earthquake

A new fence is built straight across the fault at the boundary between two plates.

Over many years, plate motion causes strain to build up and deform the earth (and fence).

The Earthquake Itself

An earthquake is a sudden burst of motion that relieves the strain and causes shaking.

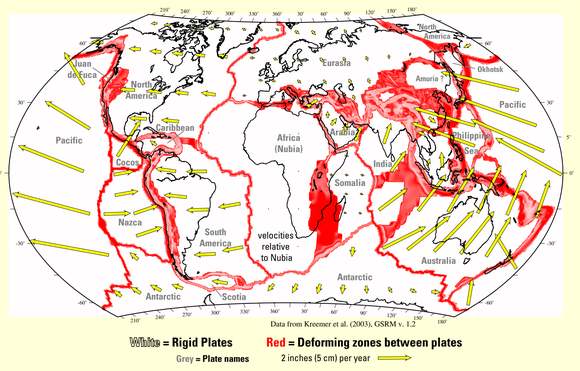


The cycle continues because plate motion continues.

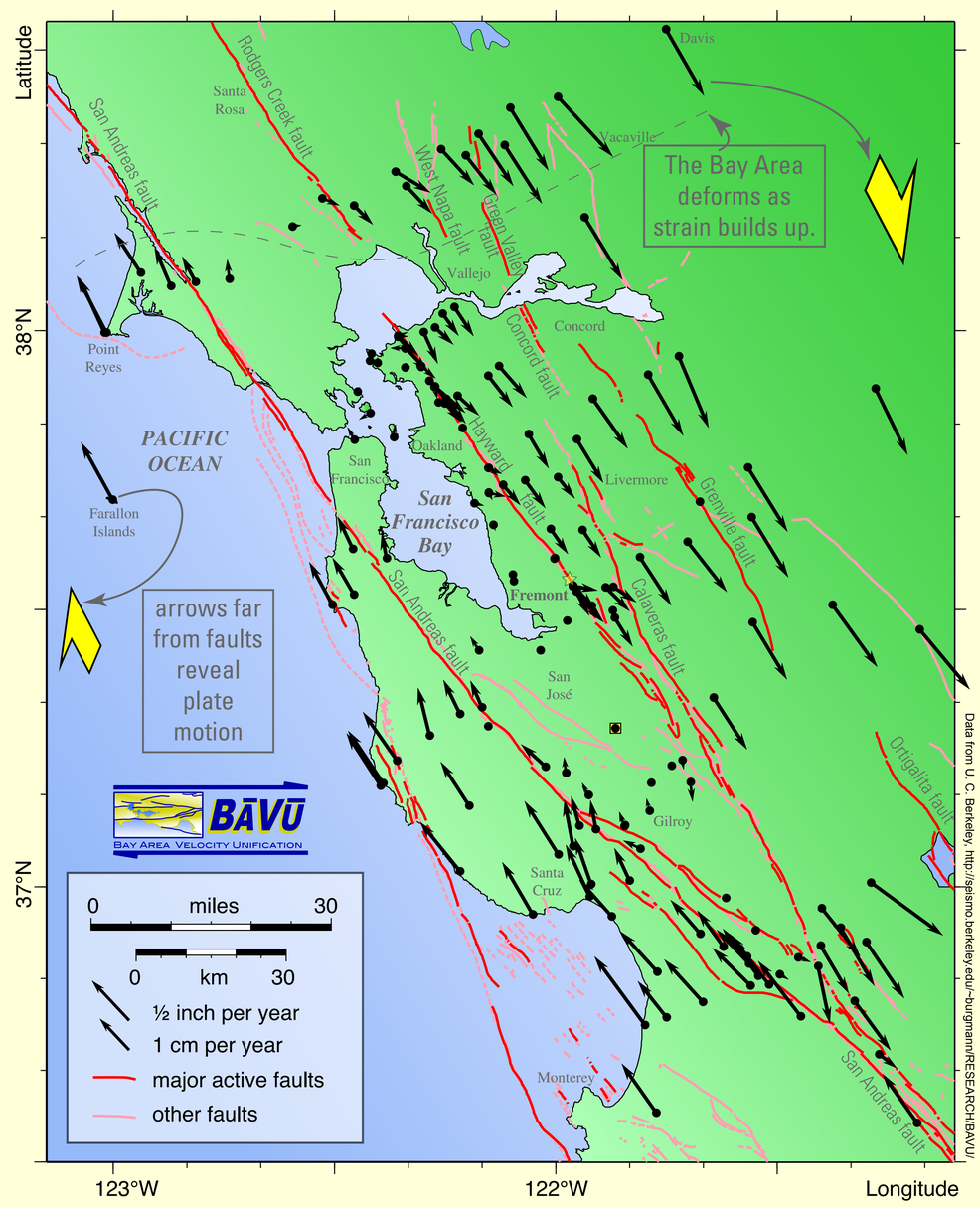
What does this motion tell us about the way the Earth works?

Early evidence for plate tectonics

The words “plate tectonics” did not come along for sixty more years, but we now know that the 1906 scientists discovered some of the first evidence of constant plate motions.



The white portions of the map above are parts that move along as a big piece called a “plate.” When plates collide, the areas in red act like crumple zones in a car accident. We live right in the middle of one of these zones!



San Francisco Bay Area in Motion

Scientists have been measuring the constant plate motion in the time between earthquakes so that they can determine the amount of strain that must be released in future Bay Area earthquakes.

How much closer does Santa Cruz get to San Francisco each year?

How far has it moved since you were born?

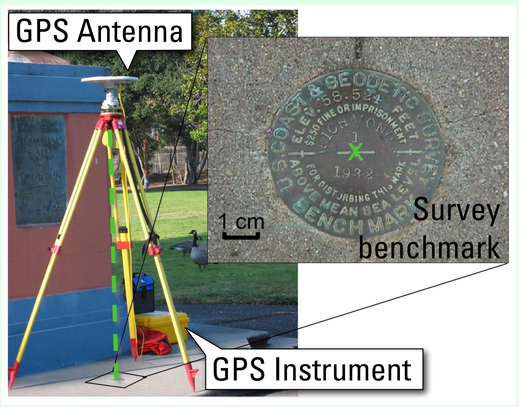
Average motion, 1993 - 2003, measured using high precision GPS.

Arrows show the amount of motion relative to San Francisco Bay. There have been **no** major earthquakes during this time period, so almost all of the motion represents strain that has built up.

How would you measure the slow movement of the Earth’s crust?

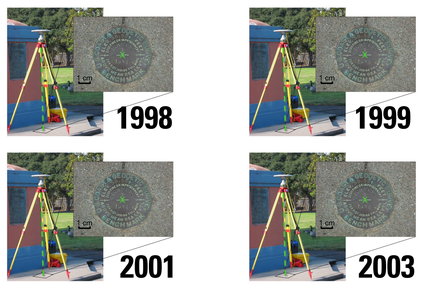
Trying to measure this slow motion is like watching your finger nails grow. Scientists make the measurements using GPS (Global Positioning System) equipment -- the same technology used by hikers and rental car navigation units, but even more precise.

Step 1:
Set up GPS antenna *exactly* over center of benchmark



Step 2:
Record the precise position using GPS instrument

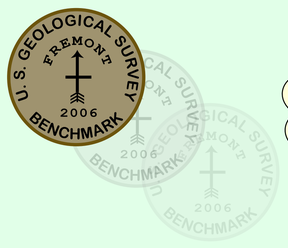
Step 3:
Repeat the process a few years later



Each arrow on the map represents several measurements of a single benchmark as much as a decade apart!

Step 4:
The position of the benchmark changed because the Earth’s crust has moved!

Year	*Latitude*	*Longitude*
1998	37.93439322 °N	122.34002390 °W
2003	37.93439377 °N	122.34002635 °W



Which direction is this benchmark moving?